

The Rufford Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Arjun Adit
Project title	Orchid Bio-Inventory Survey of Tripura, India
RSG reference	25610-1
Reporting period	June 2018 – August 2019
Amount of grant	£ 5000
Your email address	arjun.adit878@gmail.com
Date of this report	25 th September 2019

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Orchid Bio-inventory survey				A total of 50 orchid species were documented from the study area. A little over 20 of these were new records/additions in the flora of Tripura.
<i>In situ</i> Conservation				Areas for <i>in situ</i> conservation were marked and conveyed to the Forest Department after detailed consultation.
<i>Ex situ</i> Conservation				Representative specimens of each species were rehabilitated in the Heritage park, Agartala and Orchidarium, Tapania Eco-park.
Awareness				Multitude of interactions with forest guards and rangers led to discussions regarding importance of orchids in the ecosystem besides sensitisation of their protection laws (both national and international). A workshop on orchid care and conservation was also organised in collaboration with Tripura Biodiversity Board. This brought together orchid enthusiasts, forest officials, researchers, professional growers and members of an NGO.
Sharing of results				Two research papers on new records in the state have been communicated in peer reviewed journals. One poster based on literature survey has been presented in a national conference on orchids. The team has been selected for presenting a poster in World Orchid Conference to be held in Taiwan in March 2020. The team is also planning to bring out a field guide on Orchids of Tripura by 2020.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

North-east India is an overlooked region in India, both botanically and in social development context. The region experiences rainfall for about 9 months and the weather remains pleasant and conducive for fieldwork for most parts of the year. However, during monsoon season, some sites get waterlogged and rivers become swollen due floods while others suffer landslides (in hilly areas). This had led to some accessibility issues from time to time. This was overcome by logistic support extended by locals and the forest department. From August - September 2018, heavy rains and floods in the state had severely hampered the survey. Due to which a survey in August 2019 had to be conducted to complete the orchid phenological calendar.

2018 was also the year of state legislative assembly elections in the state and some areas were politically volatile to visit. However due to support from various government agencies, survey could be continued without any major glitches.

There were a few instances when timber poachers were encountered in the forest. While most were fearful of getting caught, they shouldn't be taken lightly as they travel in teams and often carry sharp instruments. Future researchers and conservationists should make a note and always request the forest department to assign a guard during such trips in jungle.

People in tribal inhabited areas were apprehensive and uncooperative during initial visits. However, regular interactions during the field visits not only established good relations, but also gave me an opportunity to sensitise them on orchid conservation.

3. Briefly describe the three most important outcomes of your project.

All the objectives targeted in the project were completed successfully. The data generated opens door to other related fields of conservation. Preliminary observations of orchid-pollinator and orchid-mycorrhiza symbiosis were made, which have both conservation and research value. Three most important outcomes of the project:

1. More than 20 new distributional records of orchids have been discovered made in Tripura. These were earlier not known to occur in the state. Identification of these taxa has inspired local scientists to explore the area botanically. These additions in the orchid flora of Tripura have been communicated as two separate research articles in international peer reviewed journals. We also plan to bring out a detailed book on the inventory of Orchids of Tripura which will serve as a lead corner stone for orchids in North-east India which lies on the fringes of Indo-Burma biodiversity hotspot.
2. Due to our extensive survey in the region, we suggested areas of high orchid diversity to be conserved *in-situ*. Since then, the Forest Department, Government of Tripura has been playing a pivotal role in their conservation. Forest protection units have been regularly patrolling areas with suitable host tree populations, thus effectively reducing poaching rate in the state. We

have also taken *ex-situ* conservation approach and introduced individuals of various orchid taxa in eco-parks besides also maintaining some live specimens in an orchidarium. We are proud to inform that we will be presenting our conservation efforts in Taiwan next year during the World Orchid Conference.

3. One of the major achievements during the project was creating awareness among all the stakeholders. Foresters, locals and enthusiasts were sensitised on the importance of orchids in the salubrious forests of Tripura. The locals were also apprised of the international/national laws under which this plant family is protected. This was achieved during various interactions during several field trips. A workshop on 'Orchid care and Conservation' was conducted by us in the study area.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

The baseline data generated through this project is not only of taxonomic importance, but also has value in conservation of the local ecosystem. Frequent interactions with locals, school children and foresters in the study area have led to sensitisation on conservation besides also educating them on the role of various stakeholders in protection of forests. Locals also were told about economic importance of many of the endemic orchids to motivate them to protect the forest ecosystems. People admitted to having a different perception about orchids post-discussion. Villagers living on the fringes of forests have also been crucial in informing/ alerting the forest department of any timber (hosts for epiphytic orchids) poaching activities, thus playing a key role in reduction of deforestation cases in the region. We also organised a workshop on 'Orchid care and Conservation' which involved many locals who were eager to learn about *ex situ conservation*. The workshop was attended by Locals, orchid enthusiasts, members of Wild Tripura Foundation (NGO), professional orchid growers, forest officials and researchers.

5. Are there any plans to continue this work?

Throughout our survey in the state, we were able to make several preliminary observations on both above and below ground orchid symbiosis. We have collected data for studying reproductive ecology in two orchid species. Reproductive strategy of orchids in India has not been systematically investigated, which becomes an impediment in ascertaining the essential requirements for their survival. Justifiably, it is important to have a clear understanding of functional floral biology, reliance on pollinator for seed set, and the other ecological association to identify constraints in reproduction and natural recruitment of orchid species. Distribution pattern of orchids in wild is largely dependent on its mycorrhizal association which in many cases are specialised interactions. Thus, it becomes equally important for conservation studies to understand which fungal partners are involved in these relationships. Such studies can help to identify and combat the problems of impeded regeneration and in developing effective conservation strategies. We plan to further our research in this direction and unravel new ways to conserve this threatened plant family.

6. How do you plan to share the results of your work with others?

Two research papers pertaining to additions of orchid flora in the study area have been communicated in international peer reviewed journals of good repute. The team is planning to bring out a field guide (book) on Orchids of Tripura, which will be based on the extensive field survey conducted as a part of this bio-inventories project. A poster was materialised during the literature survey entitled “Deception and Reward in establishment of Specialized Interactions in Orchidaceae” and was presented during a National Conference on Orchidology held in February 2019. Our efforts on orchid conservation in the state have also been accepted for presentation via poster in the World Orchid Conference which is to be held in Taiwan during March 2020. We also plan to give several presentations on the work during the course of my doctoral studies.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

The original stipulated time for the project was 1 year, June 2018 to July 2019. But as mentioned earlier, due to heavy rain, flooding and landslide in the study area during August 2018, field trip could not be conducted for that month. Therefore, to construct the orchid phenological calendar and complete the survey, a field trip had to be organised during August 2019. The grant was consumed over a period of 1 year and 2 months.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Field Work	£ 2800	£ 2899	+£99	Hike in fuel prices led to increase in vehicle hiring charges. More number of trips than initially planned.
Equipment	£ 350	£ 350		Purchase of laser range finder as well as a cryocan for collection of material in liquid nitrogen.
Chemicals and consumables	£ 650	£ 650		Largely utilised for preparation of fixatives and chemicals during field collections.
Contingency	£ 400	£ 400		Stationary, tissue rolls, aluminium foils, cartage, field assistance, etc.
Documentation (Partial funding)	£ 800	£ 800		Monetary assistance under this budget head has not been

				utilised till now. Since the field work has only recently culminated in August 2019.
TOTAL	5000	5099	+£99	

The conversion rate used was £1= Rs. 88/-, which was the exchange rate when the project was approved, and funds were transferred to us.

9. Looking ahead, what do you feel are the important next steps?

Orchidaceae is the largest family of flowering plants in the world. Yet, in comparison to their diversity, their population size and distribution is largely limited. This family is phenotypically plastic and full of exceptions, thus making it a wonderful system to unravel evolutionary relationships in the plant world. Orchids also maintain intricate relationships with other biota present in their niche. Therefore, to conserve these attractive plants, studies must be holistic. Research should focus on reproductive biology, mycorrhizal relations, ecological niche modelling and phenological studies to develop methods for conservation (*in-situ*, *ex-situ* and *in-vitro*). Despite being listed under IUCN red list, CITES and protected by various international and national laws, many species have been classified as threatened. Such species should be revived (regenerated) via tissue culture activities and rehabilitated in wild. One must never forget that loss of even a single species can have a cascading effect on trophic extinction and cause imbalance in the ecosystem.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did The Rufford Foundation receive any publicity during the course of your work?

Logo of The Rufford Foundation was used in various advertisement materials such as pamphlets and banners for the 'workshop on Orchid care and Conservation'. It was also a part of the poster which was presented in national conference on Orchidology held in February 2019. RSG was also mentioned in the two research papers communicated in open access international peer reviewed journals. Both papers have taxonomic as well as conservation importance and hence will be a valuable resource for botanists.

We will also be using the RSG logo for the poster during the World Orchid Conference, to be held in March 2020 in Taiwan. The logo will be an integral part of the field guide to 'Orchids of Tripura', a book that is being materialised currently.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr. Rajesh Tandon, *Department of Botany, University of Delhi, India:* A professor of Botany, he is the most experienced field biologist on the team. Being the project leader's Ph.D. supervisor, he provided lab equipment and space to analyse data collected from field. He has played a key role in shaping publications, besides troubleshooting any difficulties faced during the project.

Dr. Monika Koul, *Botany Department, HansRaj College, University of Delhi, India:* An Assistant Professor, she is also Ph.D. co-supervisor of the project leader. Responsible for introducing the Rufford grant to the team, she has been involved in discussions and preparation of manuscripts.

Arjun Adit, *Department of Botany, University of Delhi, India:* Ph.D. candidate and Junior Research Fellow (CSIR), he designed the survey, conducted regular field trips, collected, identified and inventoried (documented) the taxa.

12. Any other comments?

A poster resulting from literature review during the project won first prize in the *National Conference on Orchidology* held in February 2019. Our orchid conservation efforts in Tripura have also been accepted for poster presentation in the *World Orchid Conference* which is to be held in Taiwan in March 2020. I have also won a *Young Fellow Award* from the organisers for the same. We had requested £800 from RSG as partial funding to produce a field guide on *Orchids of Tripura*. Fieldwork for the project has just culminated and the book is currently in planning stages. With the publication of this book, the checklist of orchid species in north-east India will be completed. We hope to release it by World Environment Day next year (5th June 2020). The content shall feature detailed descriptions and high-quality images along with taxonomic and ethno-botanical information on all orchid species of Tripura found during our survey. The publication yields a baseline data which can help in effective conservation of the geographically restricted orchid species in the region.

This project would not have been a success without sincere efforts from various people in both field and in the lab. Tripura Forest Department has been like an unofficial partner in our endeavour, providing logistical support at every stage besides also granting permission to conduct research in the state. We would also like to thank the members of Reproductive biology lab, Department of Botany, University of Delhi, Delhi for their invaluable support and motivation during the course of the project. The grant provided by The Rufford Foundation has been the driving force for me to undertake this work. Without the financial support, it would not have been possible for us to undertake the work. Sincere thanks are also due to the office bearers for their prompt and helpful replies.